REVISION OF THE ASIAN GENUS *KOILODEPAS* (EUPHORBIACEAE)[1]

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ABSTRACT

Koilodepas Hassk. (Euphorbiaceae) is a genus of nine accepted species ranging from India (*K. calycinum* Bedd.) to Southwest China, Indochina, Southeast Asia, West Malesia, and New Guinea (*K. homaliifolium* Airy Shaw). Two species are widespread on the southeastern Asian mainland and in western Malesia (*K. bantamense* Hassk. and *K. longifolium* Hook. f.), one species is present from China to Thailand (*K. hainanense* (Merr.) Croizat), three others (*K. brevipes* Merr., *K. laevigatum* Airy Shaw, *K. pectinatum* Airy Shaw) are endemic to Borneo, and a new species is found on Sumatra only (*K. cordisepalum* Welzen & Muzzaz.). The name *K. glanduligerum* Pax & K. Hoffm. is lectotypified. Typical for the species is the presence of stellately bundled hairs; spicate inflorescences with a single pistillate flower per node basally and more apically tight, globose groups of small staminate flowers per node; and staminate flowers with a broad, short androphore with the typically shaped, sulcate filaments and divergent anthers (*K. laevigatum* excepted). The species are difficult to distinguish morphologically. Typical characters of the species are found in the leaf margin (serrulate vs. entire), the base of the leaf blade (convex vs. flat), the color of the dried leaves (green or brown), the type of stamens (threadlike filaments vs. sulcate ones), and especially in the calyx and stigmas of the pistillate flowers (sepals free vs. completely united, loose vs. tight around ovary, enlarging in fruit vs. not enlarging in fruit, and degree in which stigmas branch apically).

Key words: *Coelodepas*, Euphorbiaceae, *Koilodepas*, Southeast Asia, taxonomy.

Hasskarl (1855) described the genus *Koilodepas* Hassk., referring to the stamens as the source for the name, although he did not further clarify the name. Backer (1936: 132) explained the name (as "*Coelodepas*") as a combination of the Greek words "koilon" (cavity, here meaning chamber) and "depas" (cup): the stamens form a cup, whereby each filament forms a separate chamber hiding the anthers in bud. The structure of the androecium is indeed characteristic, the four to eight stamens are placed in a circle on a short and broad androphore, the loose filaments are sulcate and narrow apically, separating the two anther thecae basally (thecae divergent). The only exception is *K. laevigatum* Airy Shaw with threadlike filaments and parallel thecae. Two years later, Hasskarl (1857) started the confusion around the generic name, when he suddenly referred to *Coelodepas* Hassk., an orthographic variant on *Koilodepas*. The name *Koilodepas* is the older and, therefore, correct original spelling for the generic name, even though a majority of later authors used *Coelodepas*, e.g., Hooker (1887: 419), Pax and Hoffmann (1914: 268), and Croizat (1942); also check the International Plant Names Index (<http://www.ipni.org>) under both generic names. Croizat (1942) even indicated that because of the (incorrect) general use of *Coelodepas*, the name should be listed in the nomina generica conservanda. Airy Shaw described most species in *Koilodepas*, although several other species were first published in other, originally monotypic genera. Blume (1856) introduced the genus *Calpigyne* Blume, and later Gagnepain (1925) described *Nephrostylus* Gagnep.; both are taxonomic synonyms of *Koilodepas*.

Koilodepas is a small Asian genus (nine species accepted herein) ranging from India to southern China, then south to the western half of the Malay Archipelago and New Guinea. Webster (1994) and Radcliffe-Smith (2001) classified *Koilodepas* in the subfamily Acalyphoideae (Euphorbiaceae s. str.), the tribe Epiprineae (based on the sepals valvate, petals absent, stamens usually inflexed in bud, disc absent, styles multifid, fruits dehiscent, and seeds with the cotyledons larger than the radicle), and the subtribe Epiprinae (bisexual inflorescences). Based on two molecular markers, *rbcL* and *trnL-F*, *Koilodepas* groups together with *Cephalomappa* Baill. as sister group, and both are sister to *Cephalocroton* Hochst. (Wurdack et al., 2005: clade A4); both nodes have high bootstrap support. Webster (1994) and Radcliffe-Smith (2001) place *Cephalomappa* in a different subtribe (Cephalomappinae) still within the Epiprineae, but the molecular data suggest unification of the subtribes. However, several Epiprinae genera are still lacking exemplars in the backbone phylogeny of the

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Euphorbiaceae s. str. (Wurdack et al., 2005: fig. 4), and thus it is premature to synonymize both subtribes.

Airy Shaw (1960) divided *Koilodepas* into two sections, section *Hyalodepas* Airy Shaw with pistillate flowers with broad calyx lobes that strongly enlarge in fruit and the autonymic section *Koilodepas* with hardly enlarging calyces or these lobes narrow. Section *Hyalodepas* comprised three species, *K. calycinum* Bedd., *K. hainanense* (Merr.) Croizat, and *K. pectinatum* Airy Shaw (Airy Shaw, 1969), which was added later. The latter species blurs the distinction between the sections, because a continuous range in sizes now exists between the species with broadly enlarging sepals, *K. pectinatum* with narrower sepals, and the enlarging, but narrow sepals of *K. brevipes* Merr. in section *Koilodepas*. Another reason why I prefer to unite both sections is that two character states of the same character are used to define the two sections (broadly enlarging sepals vs. non-enlarging or narrowly enlarging). One of the two states is plesiomorphic (the non-enlarging sepals, also present in related genera) and cannot be used to characterize a group, because this character state can never indicate the monophyly of the section.

One species complex within *Koilodepas* was especially difficult to resolve. Airy Shaw had previously struggled with these species as exemplified in his different treatments of 1960 and 1963. In later regional revisions, Airy Shaw stopped referring to this species complex, which involved the following nine names: *Koilodepas bantamense* Hassk., *K. hainanense*, *K. ferrugineum* Hook. f., *K. frutescens* (Blume) Airy Shaw, *K. glanduligerum* Pax & K. Hoffm., *K. longifolium* Hook. f., *K. subcordatum* Gage, *K. wallichianum* Benth., and *Nephrostylus poilanei* Gagnep. Within this complex, the leaves are mainly elliptic-oblong, but leaf size varies from small to large, base shape and indumentum color vary, and the blade margins are entire to serrulate. The stipules are also diverse, ranging from entire to ones with long marginal teeth (± pectinate). Even more variation is found in the pistillate flowers, in which the calyx can be high, enclosing the ovary in loose folds or enveloping the ovary so tightly as to appear absent, or the calyx can be low, extending to only half the length of the ovary. The calyx enlarges in fruit in some specimens, while in others it remains more or less the same size. The three shapes of the pistillate calyx provide the solution of the complex and distinguish the species. The loosely draped, high calyx that enlarges in fruit is typical for *K. hainanense* (with *N. poilanei* referred to it as synonym); the stipules of *K. hainanense* are mainly entire or with a few teeth only. The tightly fitting urceolate, non-enlarging calyx is typical for *K. bantamense* (with *K. ferrugineum*, *K. frutescens*, and *K. wallichianum* now recognized as synonyms); the stipules are mainly entire and small. Finally, *K. longifolium* has a short, determinate calyx that does not enlarge and stipules that are almost pectinate (*K. glanduligerum* and *K. subcordatum* are referred herein as synonyms). *Koilodepas bantamense* and *K. longifolium* are further separated by two other characters: *K. bantamense* usually has broad glandular apices of the teeth along the blade margin, while those of *K. longifolium* are generally smaller; and the two species have different witch brooms in the inflorescences (see *K. bantamense* discussion).

CHARACTERS IMPORTANT FOR IDENTIFICATION

STIPULES

The most important distinguishing character related to the stipules is the margin, which varies between entire to pectinate. More or less entire margins are found in *Koilodepas bantamense* and *K. homaliifolium* Airy Shaw (Fig. 1A, C), while strongly pectinate margins are present in *K. pectinatum* (Fig. 1E). The teeth in *K. pectinatum* are perpendicular to the stipule and some even carry smaller perpendicular teeth themselves. Other species show more or less intermediate forms, with usually a few teeth, but these usually point upward (Fig. 1C). The distinction is hampered by the old stipules, which are often persistent and start to fray along the parallel nerves; these separate nerves are similar in appearance to the teeth. However, the teeth can be distinguished from the frays by the grayish color of the old stipules (Fig. 1B).

COLOR OF DRIED LEAVES

Generally, each species dries either brown or green. A few species, like *Koilodepas hainanense* and *K. longifolium*, are variable between brownish green and brownish, but even in those species the majority of the specimens dry brownish.

BASE OF LEAF BLADE

Most species have a flat leaf blade, although the margins may be somewhat revolute. Typical for *Koilodepas brevipes* is that the blade base is strongly convex at both sides of the midrib (Fig. 1F, G), especially the basal margin, which is strongly revolute. This character is easy to observe with broad-based leaves, but more difficult to see in leaves with a narrow, cuneate base.

GLANDS OF LEAF MARGIN

The leaf blades usually have serrulate leaf margins, with the teeth ending in glands. These glands can be a

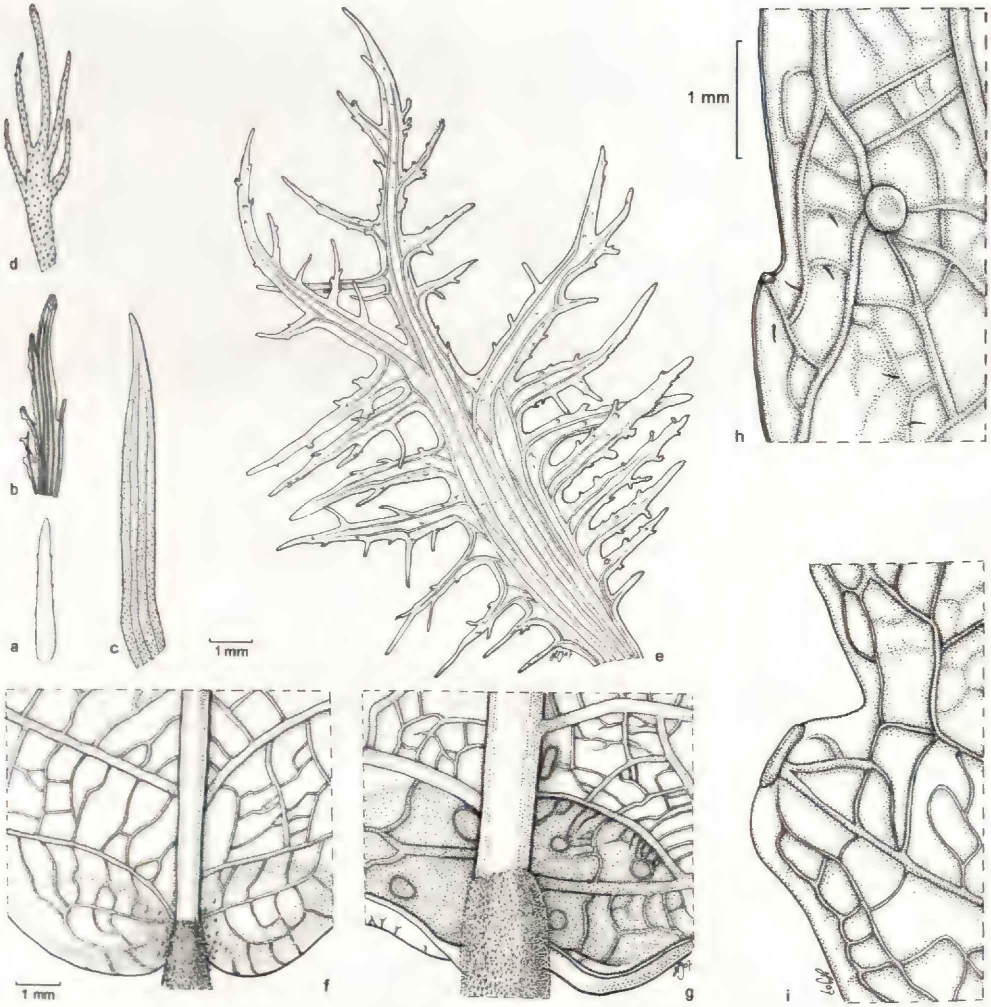

Figure 1. A–E. Stipules in *Koilodepas* Hassk. —A. *Koilodepas bantamense* Hassk.: young stipule. —B. *Koilodepas bantamense*: old stipule with frayed margin. —C. *Koilodepas homaliifolium* Airy Shaw. —D. *Koilodepas longifolium* Hook. f. —E. *Koilodepas pectinatum* Airy Shaw. F, G. Leaf base of *K. brevipes* Merr. with a convexity on both sides of the midrib. —F. View from adaxial surface. —G. View from abaxial surface; four extrafloral nectaries also visible. H, I. Leaf margins, abaxial surface. —H. *Koilodepas longifolium*: teeth with short glandular apex (extrafloral nectary also visible). —I. *Koilodepas homaliifolium*: teeth with an apical glandular zone. A drawn from *Anonymous s.n.* (barcode L 0034837 [L]); B drawn from *Pickles S 3527* (L); C drawn from *K. J. White NGF 10732* (L); D drawn from *J. Sinclair SF 40668* (L); E drawn from *Krispinus & Sumbing SAN 91753* (L); F drawn from *Kostermans 10326* (L); G drawn from *Kostermans 13949* (L); H drawn from *J. Sinclair SF 40668* (L); I drawn from *K. J. White NGF 10732* (L).

broad zone along the rounded apex of the teeth (Fig. 1I), or they can be small as in *Koilodepas longifolium* (Fig. 1H).

STAMENS

The number of stamens is variable. *Koilodepas brevipes* and *K. cordisepalum* Welzen & Muzzaz. have a higher numbers of stamens (five to eight), while the other species have four to six stamens. Stamen type is more useful as a distinguishing character. Typical for the genus are sulcate filaments that are arranged in a circle on the androphore. The filaments taper to the apex, where the broad connective causes the thecae to diverge and open inwardly via then almost horizontal slits (Fig. 2A). *Koilodepas laevigatum* is the only exception, with threadlike filaments and a narrow connective with parallel thecae (Fig. 2B).

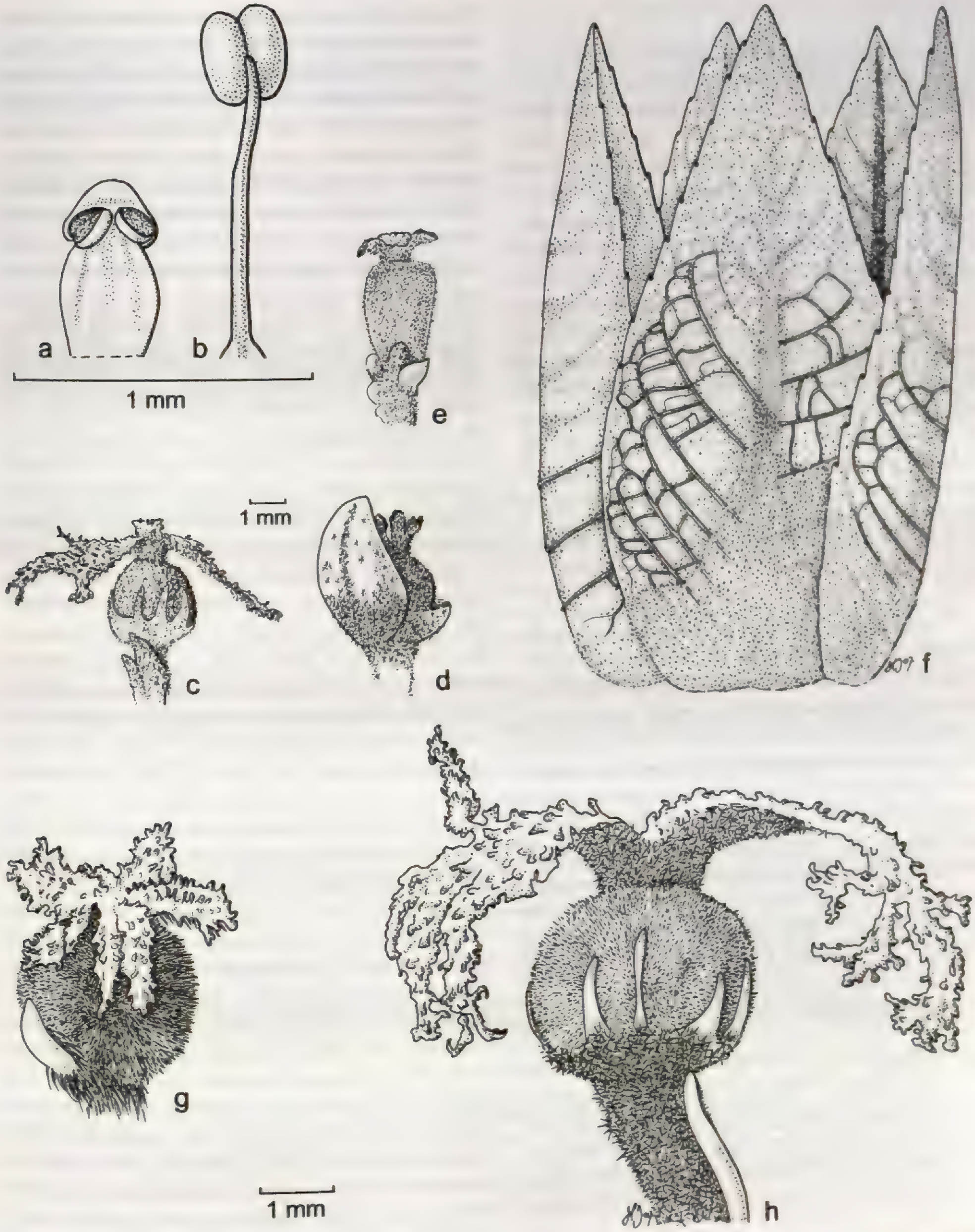

Figure 2. A, B. Stamen types of *Koilodepas* Hassk. —A. *Koilodepas longifolium* Hook. f.: general type with broad free part of the filament and divergent thecae. —B. *Koilodepas laevigatum* Airy Shaw: free part of filament threadlike, thecae parallel. C–F. Different types of pistillate flowers in *Koilodepas*. —C. *Koilodepas laevigatum*: sepals basally connate only. —D. *Koilodepas hainanense* (Merr.) Croizat: calyx lobes loosely around ovary, covering latter completely, one sepal drawn completely, others partly to show ovary. —E. *Koilodepas bantamense* Hassk.: calyx tightly around ovary, covering latter completely. —F. *Koilodepas pectinatum* Airy Shaw: enlarged calyx in fruit (several lobes caducous). G, H. Style and stigma types in *Koilodepas*. —G. *Koilodepas bantamense*: style absent; stigmas short and apices multifid; individual stigmas hardly visible. —H. *Koilodepas laevigatum*: style present; stigma apices less often split; individual stigmas visible. A drawn from *Rahim A 409* (L); B drawn from *Krispinus SAN 120047* (L); C drawn from *Othman, Yii et al. S 48861* (L); D drawn from *Nguyen Nghia Thin 010812.17* (L); E drawn from *Korthals s.n.* (barcode L 0016252 [L]); F drawn from *Lassan SAN 63541* (L); G drawn from *Singh, Talip & Nordin SAN 48984* (L); H drawn from *Othman, Yii et al. SAN 48861* (L).

PISTILLATE CALYX

The pistillate calyx provides the best characters for identification. Unfortunately, many specimens only show spikes with staminate flowers. Furthermore, the presence of fruits helps to see whether the calyx will enlarge or not. The calyx lobes can be free (sepals, e.g., *Koilodepas brevipes*), basally connate (e.g., *K. laevigatum*, Fig. 2C), or highly connate (e.g., *K. bantamense*; Fig. 2E). The calyx can cover only the basal half of the ovary (Fig. 2C) or it can completely hide the ovary, either loosely folded around it (Fig. 2D) or fitting very tightly (Fig. 2E). Most species variably show extrafloral nectaries on the calyx cup or not; these are easiest to see in fruit. The calyx always enlarges in fruit, although only slightly in some species (*K. bantamense, K. laevigatum, K. longifolium*). In most species, the calyx strongly enlarges (*K. brevipes, K. calycinum, K. cordisepalum, K. hainanense*, and *K. pectinatum*; Fig. 2F); this character is unknown for the New Guinean *K. homaliifolium.*

STYLE AND STIGMA

The style is the part on top of the ovary where the stigmas are still united, thus the part before the split. The style can be absent or present, depending on the species. The stigma apex is generally marked by a relatively deep bifurcation, as well as several smaller bifurcations. The number of splits varies by species; it can be several to many times. When the number of splits is low, the individual stigmas are still visible (*Koilodepas brevipes, K. cordisepalum, K. homaliifolium, K. laevigatum* [Fig. 2H], *K. longifolium*); when the apices are frayed multiple times and fanlike, the individual stigmas are not easily identifiable (*K. bantamense* [Fig. 2G], *K. calycinum, K. hainanense, K. pectinatum*).

TAXONOMIC TREATMENT

Koilodepas Hassk., Verslagen Meded. Afd. Natuurk. Kon. Akad. Wetensch. 4: 139. 1856. *Conceveiba* Aubl. sect. *Coelodepas* (Hassk.) Kuntze in T. Post & Kuntze, Lex. Gen. Phan. 138. 1903, orth. var. *Koilodepas* Hassk. sect. *Koilodepas* Airy Shaw, Kew Bull. 14: 383. 1960. TYPE: *Koilodepas bantamense* Hassk.

Calpigyne Blume, Mus. Bot. 2: 193. 1856. TYPE: *Calpigyne frutescens* Blume (= *Koilodepas bantamense* Hassk.).

Nephrostylus Gagnep., Bull. Soc. Bot. France 72: 467. 1925. TYPE: *Nephrostylus poilanei* Gagnep. (= *Koilodepas longifolium* Hook. f.).

Koilodepas Hassk. sect. *Hyalodepas* Airy Shaw, Kew Bull. 14: 383. 1960. TYPE: *Koilodepas calycinum* Bedd.

Trees generally small, but can range to 27 m (*Koilodepas bantamense*), monoecious; *indument* simple hairs, single or in stellate groups, often denser on younger parts and inflorescences. *Stipules* triangular to elliptic, late caducous, margin entire to (partly) erose to pectinate with even branching teeth, sometimes basal-marginal extrafloral nectaries, externally stellate groups of hairs, but internally with simple hairs. *Leaves* alternate to distichous, simple; petiole short, usually completely pulvinate, tomentose; blades usually elliptic or oblong-elliptic, symmetric, rather coriaceous, drying green or brown, base obtuse to cuneate, the extreme base narrowly emarginate, the margin entire to serrulate with teeth ending in small or broad glands, apex acuminate to cuspidate, adaxial surface smooth, generally glabrous, abaxial surface smooth, glabrous to pubescent on veins and midrib only, extrafloral nectaries generally near the petiole junction, additional nectaries often nearby and often along the margin up to the apex, domatia absent; venation penninerved, slightly raised adaxially, distinctly so abaxially, nerves looping and connected near the margin, tertiary veins often scalariform, others reticulate. *Inflorescences* spicate (ramiflorous, in *K. bantamense* and *K. brevipes*) to axillary (to terminal, in *K. bantamense*), often several together, ± pendulous, completely staminate or lower flowers pistillate and upper ones staminate, the staminate part breaking off at fruit set; staminate flowers in dense clusters of generally 10 or more flowers per node, pistillate flowers solitary per node (or with a few staminate ones); rachis tomentose. *Flowers* actinomorphic; bracts present and, especially with the pistillate flowers, bracteoles also present, both with an often erose margin, outside with stellate bundles of hairs and inside simple ones, externally often extrafloral nectaries basally; petals and disc absent. *Staminate flowers* small; pedicel very short, to 0.9 mm, widening apically, with few hairs; calyx generally 2- to 4-lobed, lobes valvate, stellate pubescent outside, with simple hairs inside; stamens glabrous, united on a short androphore that apically broadens, 4 to 8, in a circle, the filaments either sulcate in the lower 2/3 and narrowing apically with thecae divergent, or filaments threadlike (*K. laevigatum*) and anthers with parallel thecae, anthers subapically dorsifixed, opening introrse with short longitudinal slits; pistillode absent to short, protruding from center of androphore. *Pistillate flowers* much larger than staminate ones; pedicels short, apically broadening, pubescent, often elongating considerably in fruit; sepals or calyx lobes imbricate, persistent, either sepals free and triangular to basally or almost completely united, calyx to ca. 10-lobed, either free from the ovary or enclosing it completely and tightly with the calyx seemingly absent, (in some species, the calyx enlarging to cover the fruit), externally stellate bundles of hairs, simple hairs internally; ovary (2)3(4)-locular, villose, 1 ovule per locule; style absent to present, stigmas as many as locules, apically several times bifid (stigmas individually identifiable) to multifid and fanlike (individual stigmas not visible), the upper surface with long, branching stigmatic papillae, tomentose beneath. *Fruits* as lobed regmata (capsules), dehiscing completely septicidally and partially loculicidally in the upper half, externally tomentose (somewhat scurfy), internally a few stellate hairs at the base; the wall woody; columella very sturdy, broadly obtriangular with large septal remnants. *Seeds* obovoid, somewhat flattened and keeled on the inside, smooth, shining, often somewhat marbled, hilum triangular, caruncle absent; endosperm fleshy; cotyledons broad, flat.

Distribution. The genus comprises nine species: one in India, one from South China to central Thailand, two widespread from Thailand to Borneo and Sumatra (one extending to Java), one in New Guinea, and all others mainly endemics of Borneo and one of Sumatra.

Discussion. Hasskarl (1855, 1856) first used the Greek version of the genus name, *Koilodepas*, which he later changed (1857, 1858) to a more Latinized form, *Coelodepas*. *Koilodepas* is the older variant and, therefore, is used in this revision.

Croizat (1942) indicated the type of the genus (*Koilodepas bantamense*) to be a nomen nudum. This is inaccurate, because Hasskarl published a monotypic genus and the conditions for a "descriptio generico-specifica" are otherwise satisfied by Article 42.1 of the *International Code of Botanical Nomenclature* (McNeill et al., 2006).

KEY TO THE SPECIES OF *KOILODEPAS* IN SOUTHERN ASIA AND MALESIA

1a. Leaf blades large, 13.5–34 × 3–13 cm, drying green, margin irregularly entire, seldom apically with one or a few teeth; free part of filaments threadlike, 1.3–2.4 mm long, anthers with parallel thecae; pistillate calyx not enlarging in fruit; Borneo . . . . 7. *K. laevigatum*

1b. Leaf blades small to large, 3.5–33 × 1.3–11.2 cm, drying greenish or brownish, margin (entire to) serrulate (to secondarily entire in older leaves); free part of filaments 0.4–1.5 mm long, of which lower 2/3 sulcate, upper part thinner, anthers with divergent thecae; pistillate calyx enlarging or not enlarging in fruit; all areas.

2a. Stipules oblong-ovate, 10–13 × 1.5–3 mm (excluding teeth), pectinate with up to 6-mm-long teeth, perpendicular to main part, teeth with secondary perpendicular teeth; pistillate calyx lobes enlarging; Malay Peninsula, Borneo . . . . 9. *K. pectinatum*

2b. Stipules triangular, 1.8–10 × 0.6–1.5 mm, margin entire to with several upright, nonbranching teeth; pistillate calyx enlarging or not enlarging in fruit; all areas.

3a. Leaf blades at base poculiform (convex, margin strongly recurved); pistillate sepals free to basally connate, enlarging in fruit; Borneo . . . . 2. *K. brevipes*

3b. Leaf blades at base flat; pistillate calyx lobes basally connate (then not enlarging in fruit) to calyx enveloping ovary (then enlarging or not enlarging in fruit); all areas.

4a. Pistillate calyx only enveloping lower half of ovary; blade teeth ending in a small and narrow gland; stigmas not strongly splitting, separately visible . . . . 8. *K. longifolium*

4b. Pistillate calyx enveloping ovary completely (sometimes very tightly so and ending under strongly branching pistils and then seemingly absent); blade teeth generally ending in a broad, marginal gland; stigmas separately visible or not, due to strong apical splitting.

5a. Leaves drying green; pistillode 0.8–1 mm long; style (united part of all stigmas) 0.8–1.6 mm long; stigmas 4–5.5 mm long, apically splitting, but stigmas separately visible; Sumatra . . . . 4. *K. cordisepalum*

5b. Leaves drying green or brown; pistillode absent to up to 0.3 mm long; style absent to up to 0.5 mm long; stigmas 2–3.2 mm long, stigma lobes densely splitting, not separately visible to splitting a few times and stigmas separately visible; all areas (but only other species on Sumatra, *K. bantamense*, generally drying brownish and stigmas not separately visible).

6a. Pistillate calyx tightly urceolate around ovary (seemingly absent), not to slightly enlarging in fruit (up to 5 mm high); stipule margins somewhat erose or with at most 1 or 2 upright teeth; stigmas not separately visible; fruits 16–18 mm wide; Thailand, Laos, Malay Peninsula, Sumatra, Java, Borneo . . . . 1. *K. bantamense*

6b. Pistillate calyx loosely folded over ovary, enlarging in fruit (more than 10 mm deep; unknown for New Guinea *K. homaliifolium*, but in this species stigmas separately visible); stigmas separately visible or not; fruits 12–16 mm wide (unknown for *K. homaliifolium*); India, China, Vietnam, Thailand, New Guinea.

7a. Stipules 4.3–9 × 1–1.5 mm, margin entire but apically sometimes erose. Leaves drying brown, young ones reddish; pistillate calyx lobes basally connate; stigmas separately visible; New Guinea . . . . 6. *K. homaliifolium*

7b. Stipules 1.8–8 × 0.6–1.5 mm, margin erose with up to 1-mm-long teeth; pistillate calyx lobes connate in lower third; stigmas not separately visible; India, China, Vietnam, Thailand.

8a. Leaves drying greenish, blade elliptic (to obovate), 3.5–15.5 cm long; stipules 1.8–3.5 × 0.6–1 mm; pistillate calyx lobes 5 or 6; India . . . . 3. *K. calycinum*

8b. Leaves drying brownish to sometimes greenish, blade (ovate to) elliptic-oblong (to obovate), 6.5–22.5 cm long; stipules 3.5–8 × 1–1.5 mm; pistillate calyx lobes 8 to 10; China, Vietnam, Thailand . . . . 5. *K. hainanense*

1. **Koilodepas bantamense** Hassk., Verslagen Meded. Afd. Natuurk. Kon. Akad. Wetensch. 4: 140. 1855. TYPE: Indonesia. Java: originally collected in Bantam, type from cultivated tree in Bogor Botanical Garden, s.d., *J. C. Hasskarl s.n.* (holotype, L! [barcode L 0016250]). Figures 1A, B, 2E, G.

Calpigyne frutescens Blume, Mus. Bot. 2: 193. 1856. *Ptychopyxis frutescens* (Blume) Croizat, J. Arnold Arbor. 23: 49. 1942. *Koilodepas frutescens* (Blume) Airy Shaw, Kew Bull. 14: 385. 1960. TYPE: Indonesia. Borneo: Gunung Pamatton, s.d., *P. W. Korthals s.n.* (lectotype, designated by Croizat, 1942: 49, L! [barcode L 0016252], photo A!).

Koilodepas wallichianum Benth., Hooker's Icon. Pl. 13: t. 1288. 1879, as *Coelodepas wallichianum*, syn. nov. TYPE: Malaysia. Penang Hills, s.d., *G. Porter s.n.* [*Hb. Wallich 9098*] (holotype, K-WALL not seen; isotype, K!).

Koilodepas ferrugineum Hook. f., Fl. Brit. India 5: 420. 1887, syn. nov. TYPE: Malaysia. Malacca, s.d., *W. Griffith KD 5017* (holotype, K!; isotype, L! [barcode L 0016235]).

Shrubs to trees to 27 m high, to 50 cm DBH; flowering branches 1.5–4 mm diam. *Outer bark* smooth, white to patchy gray and gray-green to gray-brown to honey-colored, papery, sometimes flaking, soft; inner bark pink to reddish brown to brown, thin, brittle-fibrous; wood medium hard, sapwood cream to yellow, heartwood yellow to orange. *Stipules* triangular, 2–8 × 0.6–1.5 mm, margin often somewhat erose or with at most 1 or 2 upright teeth, mainly on one side. *Leaves* with the petioles 3–16 mm, round to flattened above; blades ovate-oblong to elliptic-oblong, 5.8–33 × 1.7–11.2 cm, length:width ratio 2.7–5.3:1, drying (greenish brown to) brown, base truncate to cuneate, flat, margin coarsely serrulate (to entire), flat to slightly recurved, teeth ending in a glandular region, apex acute to cuspidate, adaxial surface dull dark green, abaxial surface dull green; glabrous to pubescent along the basal midrib, secondary nerves 11 to 15 per side, often somewhat bullate between nerves. *Inflorescences* to 10.5 cm, yellowish green to pale brown, with the flowers white in bud to gray-yellow when dehisced. *Staminate flowers* 1.2–2.4 mm diam.; bracts triangular, 1.1–2.2 × 1.1–3.5 mm, sometimes with marginal teeth, often with extrafloral nectaries basally; pedicels 0.2–0.9 mm; calyx 1–1.2 mm high, 3- or 4-lobed; lobes triangular, 0.7–1.2 × 0.8–1.4 mm; stamens 4 or 5, androphore 0.7–0.8 mm high, filaments 0.7–1 mm, sulcate, anthers 0.2–0.3 × 0.3–0.5 mm, thecae divergent, yellow; pistillode absent or to ca. 0.2 mm. *Pistillate flowers* 2.5–3.5 mm diam.; bracts triangular, 2–7 × 1.2–2.3 mm, margin often with round extrafloral nectaries, often united with the bracteoles; bracteoles similar to bracts, much smaller, 1.8–2.5 × 0.6–1.8 mm; pedicels 0.7–1.8(–22 in fruit) mm; calyx tightly urceolate and adnate to ovary, 2–3.3 mm high, 7- or 8-lobed, lobes inconspicuous, externally usually with extrafloral nectaries on calyx tube, splitting into reflexed (to horizontal) lobes, in fruit the calyx not markedly increasing in size, to 3(–5) mm long; ovary 3-locular, 2–3 × 1.5–2.7 mm, style 0–0.3 mm, stigmas 1.5–2.5 mm, yellow, deeply bilobed, each lobe split several times, spreading and fanlike, very compact, individual stigmas not visible. *Fruits* as lobed regmata, 16–18 × 8–11 mm, yellowish green when young, to orange with brown hairs; wall ca. 1.2 mm thick; columella 6–10 × 4.5–7.3 mm. *Seeds* 7–8.5 × 7.2–9 × 6–8.2 mm.

Distribution, habitat, and phenology. *Koilodepas bantamense* is present in Thailand (southwestern and peninsular parts) and Laos; in Malesia it is found in the Malay Peninsula, Sumatra, Java, and Borneo. It is found in primary dry evergreen forest (Thailand), primary rainforest, and sometimes also in secondary forest, scrub, and overgrown rubber plantations on yellow-red loam above a granite or sandstone bedrock between 50 and 400 m. The species flowers from January to August and fruits in May, June, October, and November.

Vernacular names. Sumatra, Lampung Province: kayoe toelan. Borneo, Sarawak: luti (Kayan language).

Economic uses. The wood is used for wood carving, knife handles, and sheaths.

Discussion. *Koilodepas bantamense* is a variable species and is very similar to *K. longifolium* and *K. hainanense.* All three species often have generally elliptic-oblong leaves with an entire to coarsely serrulate margin. Specimens previously stored under the names *K. bantamense*, *K. ferrugineum*, *K. frutescens*, *K. wallichianum*, and partly under *K. longifolium* have pistillate flowers with a narrowly urceolate calyx (with or without glands) that does not enlarge in fruit. The stigmas are short and branch into broad fans. The stipules generally have an entire margin or have one or two teeth. *Koilodepas hainanense* differs in the pistillate flowers with calyces that are loosely folded around the ovary and that enlarge in fruit; the stipules also show more teeth. The calyx of the pistillate flowers of *K. longifolium* (including *K. glanduligerum* and *K. subcordatum*) reaches only to the mid-portion of the ovary and slightly enlarges in fruit; the stigmas are less often divided and generally have a longer unbranched basal portion; and the stipules usually have distinct teeth. The distribution of *K. hainanense* only slightly overlaps with that of *K. bantamense* in southwestern Thailand. However, *K. bantamense* and *K. longifolium* largely overlap in distribution. Luckily, there is one more character that generally separates these two species: *K. longifolium* has very small glands on the marginal teeth of the leaf blades, while *K. bantamense* generally has glands that broadly cover the rounded apex of the marginal teeth. Dried material known as *K. ferrugineum* (only the type specimen) has a very dark brown indumentum and tends to be pubescent. The specimens referred to *K. wallichianum* have relatively large leaves with a truncate blade base, but this is otherwise the only differing character. The name *K. wallichianum* is treated as a synonym here, because a comparable variability in the shape of the leaf base is also seen in *K. bantamense*. *Koilodepas bantamense* and *K. longifolium* often have witch brooms that develop in the inflorescences, which differ by the species. In particular in *K. bantamense*, the bracts, bracteoles, and calices are enlarged, with only a few bracts within the calices, while in *K. longifolium* the bracts and bracteoles are normal, the calices are slender and on relatively long pedicels, but inside each calyx there are far-extending, spikelike structures consisting only of bracts. Airy Shaw (1981: 311) indicates that the "witches' broom" inflorescences are the result of mite attacks (*Lörzing 16329*, L).

The names *Koilodepas bantamense* and *Calpigyne frutescens* were traditionally and previously treated as separate species, principally because different botanists reviewed different specimens and considered the floras of different islands: Java (Backer & Bakhuizen van den Brink f., 1963), Sumatra, and Borneo (Airy Shaw, 1975, 1981), respectively. In specimens identified as *K. bantamense* and *C. frutescens*, the typical features in common are the strongly urceolate pistillate calyx, which coheres to the young ovary but dehisces when the fruit develops; the barely serrate leaves, especially in the lower half; the short stipules, less than 8 mm; and fewer stamens, four or five versus eight elsewhere in the genus.

Blume (1856) did not indicate the specimens he used in the protologue for *Calpigyne frutescens*, only that they were from Sulawesi (Celebes) and Borneo. According to Miquel (1859), the Sulawesi collections were made by Forsten and the Borneo ones by Korthals. However, the Sulawesi specimens could not be retraced (they were probably a very different taxon, because *Koilodepas bantamense* is not known for this island), and Croizat (1942) selected a Korthals specimen as lectotype from the material present in L.

Croizat (1942) indicated that his combination *Ptychopyxis frutescens* was a nomen novum (and it was subsequently treated as a new name in *Koilodepas* by Airy Shaw [1960, 1975]). However, Croizat did clearly refer to Blume's name (1856) as the basionym, thus his *P. frutescens* was validly transferred, even though he omitted to acknowledge Blume as author of the basionym.

Additional specimens examined. INDONESIA. **Jawa Barat:** *F. W. Junghuhn 98* (L); Preanger, Palabuhan Ratu, *S. H. Koorders 11754* (L). **Jawa Timur:** Bogor, cultivated at Botanical Garden, *J. G. Boerlage s.n.* (L [barcode L 0034800]), *Hortus Bogoriensis IX.C.36* (L), *Hortus Bogoriensis IX.C.36a* (L), *Hortus Bogoriensis XII.B.VII.145* (L), *Hortus Bogoriensis XII.B.IX.39* (L). **Kalimantan Selatan:** Martapoera, Djoengoer, *bb 10382* (L); Gunung Pamattan, *Unknown s.n.* (L 0034837). **Sumatra.** Atjeh: Middle Alas River (Lae Sauraya) area, ca. 15 km N of Gelombang, S of Bengkong River, 2°55′N, 97°57′E, *W. J. J. O. de Wilde & B. E. E. de Wilde-Duyfjes 20317* (L). Lampung: Gunung Trang, *H. O. Forbes 1532* (L), *C. G. C. Reinwardt s.n.* (L 0034788). Sumatera Utara: Sibolangit Garden, *J. A. Lörzing 5092* (L), *J. A. Lörzing 5615* (L); Gunung Rinte, hot water lake Laulintang, *J. A. Lörzing 16329* (L). MALAYSIA. **Negeri Sembilan:** Compart. 8, Gunung Angsi, *H. S. Loh FRI 17343* (L). **Sabah:** Tawau, Tinagat Forest Reserve, *J. Singh, A. Talip & Nordin SAN 48984*. **Sarawak:** Kenaban River, Upper Plieran, 2°38′N, 114°35′E, *G. H. Pickles S 3520* (L), *G. H. Pickles S 3527* (L). **Terengganu:** Ulu Sungai Trengan, near Kampung Petang, *P. F. Cockburn FRI 8426* (L). SINGAPORE. Singapore Garden, rockery, *H. N. Ridley 4426* (K). THAILAND. **Peninsular:** Trang Prov., Kao Pad Pha near Patthalung, *R. Geesink, T. Hattink & C. C. Charoenphol 7270* (L); Krabi Prov., Nawong Le, *A. F. G. Kerr 18637* (L); Krabi Prov., Panom Bercha, *A. F. G. Kerr 18670* (L); Surat Thani Prov., T.K. Panom, *A. F. G. Kerr 18813* (L); Songkhla Prov., Haad Yai Distr., Ko Hong Hill, *J. F. Maxwell 85-448* (L); Surat Thani Prov., Kaw Samui, *N. Put 843* (L). **Southwestern:** Prachuap Khiri Khan Prov., Thap Sakae, Huay Yang Natl. Park, 11°36′30″N, 99°33′80″E, *D. J. Middleton et al. 2541* (L); Prachuap Khiri Khan Prov., Bang Saphan, Huay Yang Natl. Park, 11°27′N, 99°25′E, *D. J. Middleton et al. 2603* (L).

2. Koilodepas brevipes Merr., Philipp. J. Sci. 30: 80. 1926, as "*Coelodepas*." TYPE: [Malaysia. Sabah:] British North Borneo, Kalumpang, 25 July 1924, *D. D. Wood 1291* (holotype, UC; isotype, K!). Figure 1F, G.

Koilodepas stenosepalum Airy Shaw, Kew Bull. 14: 390. 1960, syn. nov. *Koilodepas brevipes* Merr. var. *stenosepalum* (Airy Shaw) Airy Shaw, Kew Bull., Addit. Ser. 4: 138. 1975. TYPE: [Indonesia.] Borneo: Gunung Sahara, Belajan River, 16 Aug. 1956, *L. L. Forman 442* (holotype, K!; isotype, L!).

Undershrubs to small trees, to 10 m high, to 20 cm DBH; flowering branches 2–3 mm diam.; *outer bark* smooth, white to light brown; inner white to pale gray; sapwood white to yellowish white, hard. *Stipules* triangular, 3.7–10 × 0.7–1.2 mm, margin often erose, generally with a round, black, shiny gland basally on one side. *Leaves* with the petiole 3–7 mm, round to channeled above; blade elliptic to oblong (or ovate), 8–32.5 × 2–11 cm, length:width ratio 2.7–5:1, drying brown, base truncate to rounded (to cuneate), poculiform (convex), margin coarsely serrulate with glandular teeth, strongly recurved at base, apex caudate, mucronate; abaxial surface subglabrous to somewhat pubescent on venation, nerves 13 to 15 per side, somewhat bullate between the nerves. *Inflorescences* to 10.5 cm long, greenish brown. *Staminate flowers* 1.3–1.7 mm diam., green to pale white-yellow to yellow to yellowish gray to white, fragrant with the smell of lemon; bracts triangular, 0.6–2.2 × 1–2.2 mm, margin often with teeth, at base with round, shiny extrafloral nectaries; pedicels 0.3–0.8 mm; calyx 1.3–2.2 mm high, with 3 or 4 lobes, the latter 0.6–1 × 0.7–1 mm; stamens 6 to 8, androphore 0.6–1.5 mm, filaments 0.7–0.9 mm, sulcate, anthers ca. 0.3 × 0.3–0.4 mm, thecae divergent; pistillode 0.3–0.7 mm. *Pistillate flowers* ca. 2.2 mm diam.; bracts triangular, 2–3.5 × 1–2 mm, margin serrate, with basal glands; bracteoles similar to bracts, smaller, 1–1.5 × 0.3–0.5 mm; pedicel ca. 0.3 mm, lengthening in fruit to 16 mm; calyx with 6, 8, or 10 free or basally connate lobes, the latter triangular, 1.5–1.8 × 0.7–0.8 mm when young, extending in fruit up to 12 × 2 mm, basally and often halfway along margin with round, shiny extrafloral nectaries, less conspicuous when young, but distinct in fruit; ovary 3(4)-locular, 1.8–2 × 1–1.3 mm, style 1–3 mm, stigma 1.8–3 mm, the apex split twice to several times, usually with 2 or 3 main lobes, stigmas individually visible. *Fruits* lobed regmata, 14–18 × 8–11 mm, red to reddish black to golden brown; wall ca. 0.8 mm thick; columella 7–8 × 8–9 mm. *Seeds* ca. 7 × 6.5–6.8 × 6–6.5 mm.

Distribution, habitat, and phenology. *Koilodepas brevipes* is endemic to Borneo in primary or disturbed forest, on flat to undulating terrain or ridges, and along roadsides on dark red-brown to yellowish black soil, sandy loam, or sandstone at altitudes up to 330 m. The species flowers in January, March, April, July, and August to November; and fruits in March, August, October, and December.

Vernacular names. Borneo, Sabah: ulas; Kalimantan Timur: kaju gading.

Discussion. Airy Shaw (1960) published *Koilodepas stenosepalum*, which he later transferred as *K. brevipes* var. *stenosepalum* (Airy Shaw, 1975). However, I could not detect significant differences between *K. brevipes* var. *brevipes* and *K. brevipes* var. *stenosepalum*. The calyx lobes of the pistillate flower are short in flower and become longer and slender in fruit. *Koilodepas brevipes* var. *stenosepalum* was noted by Airy Shaw (1975) to have longer, more slender sepals, but other than the basal connection between the sepals, which is present in *K. brevipes* var. *brevipes* but less distinct in variety *stenosepalum*, the plants represent the same taxon. The most typical character for *K. brevipes* is the poculiform base of the leaf blade, as well as the pistillate sepals, which are almost free and extending in length in fruit. There seems to be no difference between the two varieties, and *K. brevipes* var. *stenosepalum* is synonymized here.

Additional specimens examined. INDONESIA. **Kalimantan Tengah:** Headwaters of Sungai Kahayan, 5 km NW of Tumbangsian logging camp, Sikatan Wana Raya concession, 0°35′S, 113°25′E, *J. S. Burley & Tukirin et al. 707* (L); Upper Katingan River, ca. 50–100 km WNW of Tumbang Samba, K.T.C. logging area, W Base Camp, ca. 96 km W of Batu Badinding, 1°15′S, 112°40′E, *J. P. Mogea 4275* (L); Upper Katingan River, ca. 50–100 km WNW of Tumbang Samba, K.T.C. logging area, near Central Base Camp, ca. 55 km W of Batu Badinding, 1°15′S, 112°40′E, *J. P. Mogea 4427* (L); Ulu Barito, P.T. Pamenang logging concession rd., ca. Km 20, *K. Sidiyasa PBU603* (L); KTC Tumbang Sah, Km 96 Katingan River, 1°15′S, 113°10′E, *H. Wiriadinata 3518* (L). **Kalimantan Timur:** Gunung Labang, *Amdjah 365* (L); Berau Inhutani area, Km 16, trayek D, *Z. Arifin et al. Berau 920* (L); Sungai Ritan, *bb 32503* (L); Berau Inhutani area, Km 45, along transect L, 1°50′N, 117°08′E, *P. J. A. Keßler et al. Berau 857* (L); Bulungan, Sebakis River region, *A. J. G. H. Kostermans 9317* (L); Central Kutei, Belajan River, near Long Bleh, *A. J. G. H. Kostermans 10326* (L); Berouw, Mapulu, at foot of Mt. Ilas Mapulu, *A. J. G. H. Kostermans 13949* (L); Berau, Tdg. Redeb, Kelai River near Long Lanuk, *A. J. G. H. Kostermans 21079* (L); Nunukan, N of Tarakan, *W. Meijer 1913* (L); ca. 15 km NE of camp of P.T. Kutai Timber C., Tabang, *G. Murata et al. B-939* (L); Batu Penalong, Mahakam, *H. Wiriadinata 802* (L); Long Le'es, Kecamatan Muara Ancalong, *H. Wiriadinata 1169* (L). MALAYSIA. **Sabah:** Mostyn, Ulu Kalumpang Forest Reserve, Kunak, *B. Ahmad SAN 64657* (L); Elphinstone Prov., Tawao, *Elmer 208212* (L), *Elmer 21512* (L); Tawau, Merotai Besar, *A. Gibot SAN 31331* (L); Kalabakan, Bukit Tuku, mi. 8, Luasong Rd., *F. Krispinus SAN 95856* (L); Kalabakan, Ulu Sungai Sepaku Forest Reserve, *F. Krispinus & Sumbing SAN 95718* (L); Tiram River, *Maidin 3667* (L); Sandakan, Ulu Sungai Melikop, *Sigin & Ismail SAN 60275* (L); Lahad Datu, Bukit Silam, *H. T. Sinanggul SAN 57289* (L); Tawau, Sub-compart. 4, compart. 5, Bombay Burmah T.C. Concession, Kalabakan, 30 mi. WNW of Tawau, *G. H. S. Wood A 4106* (L). **Sarawak:** Kuching, Selang Forest Reserve, *I. Paie S 8463* (L); 4th Division, Miri, Suai, Block 15, Bintulu Lumber Co. area, *I. Paie S 39175* (L); 3rd Division, Balingian, Ulu Sungai Arip, Bukit Iju, *Sibat ak Luang S 23656* (L); 4th Division, Bintulu, Nyabau catchment area, *Sibat ak Luang S 24520* (L); Kuching, Santubong, *L. P. Zehnder S 9570* (L).

3. **Koilodepas calycinum** Bedd., Fl. Sylv. S. India: 207 (manual), tab. 320 (part 2). 1873, as "*Coelodepas*." TYPE: India. Tinnevelly Hills/Forests/Ghats, 2000 ft., s.d., *R. H. Beddome 7329* (holotype, BM!; isotypes, K!, MH not seen).

Small trees, to 6 m high; flowering branches 1.5–2 mm diam. *Bark* and wood unknown. *Stipules* triangular, 1.8–3.5 × 0.6–1 mm, margin with teeth to 1 mm, often a round, black, shiny gland basally on one side. *Leaves* with the petiole 2–5 mm, somewhat flattened above; blade elliptic (to obovate), 3.5–15.5

× 1.3–5 cm, length:width ratio 2.7–3.1:1, drying green, base rounded, margin regularly crenulate to serrulate with glandular teeth, flat, apex acuminate to cuspidate, with cusp rounded, abaxial surface glabrous, nerves 9 or 10 per side. *Inflorescences* to 10 cm. *Staminate flowers* [not seen, described from sketch on K type] minute; pedicel very short; calyx 3- or 4-lobed; stamens 4 or 5 on a short androphore, filaments sulcate, thecae divergent; pistillode not depicted. *Pistillate flowers* with the bracts triangular, ca. 2.2 × 1 mm, margin entire, bracteoles not seen; pedicels 6–7 mm in fruit; calyx ca. 2.5 mm high, enlarging to 14 mm in fruit, connate in the basal third, somewhat pubescent on both sides, lobes triangular in fruit, 2–4.8 × 3–4 mm, extrafloral nectaries present especially on the connate portion; ovary 2- or 3-locular, style absent, stigmas 2–2.5 mm, flat, spreading, stigmas not separately visible. *Fruits* lobed regmata, 13–16.7 × ca. 9 mm; wall ca. 0.8 mm thick; columella ca. 6 × 6 mm. *Seeds* ca. 6.5 × 6.2 × 5.8 mm.

Distribution, habitat, and phenology. *Koilodepas calycinum* is endemic in southern India (Tamil Nadu State), where it is found fruiting in May at altitudes between 670 and 830 m.

Economic uses. Good timber.

Additional specimens examined. INDIA. s. loc., *R. Wight KD 2677* (L); Tinnevelly Hills, *Beddome s.n.* (BM).

4. **Koilodepas cordisepalum** Welzen & Muzzaz., sp. nov. TYPE: Indonesia. Sumatra: Atjeh Prov., Middle Alas River (Lae Sauraya) area, ca. 15 km N of Gelombang, S of Bengkong River, 80 m, ca. 2°55′N, 97°57′E, 25 July 1985, *W. J. J. O. de Wilde & B. E. E. de Wilde-Duyfjes 20339* (holotype, L!).

Folia viridia in sicco, margine grosse serrulata, nervis tertiariis quaternariisque in paginis ambabus bene visibilibus. Flos staminatus: stamina 5 ad 7, basi connata. Flos pistillatus: calyx usque ad 3.2 mm altus (in fructu usque ad ca. 18 mm accrescens), lobis 6 basi connatis triangularibus 2.3–2.8 mm longis 1–1.5 mm latis (in fructu usque ad ca. 8 mm longis latisque accrescentibus); stylus 0.8–1.6 mm longus stigmatibus 4–5.5 mm longis.

Shrubs or trees, to 12 m high, to 30 cm DBH. *Stipules* triangular, 2.5–5.5 × 0.7–1 mm, margin slightly erose, basally generally a round, black, shiny gland on one side. *Leaves* with the petioles 2–9 mm, round; blade ovate to elliptic to oblong, 8.5–22 × 2.4–10 cm, length:width ratio 2.2–3.5:1, drying green, base rounded, flat, margin somewhat recurved, coarsely serrulate with glandular teeth, apex caudate; abaxial surface slightly pubescent on midrib, venation distinct, also quaternary veinlets, nerves 10 to 13 per side, slightly bullate between the nerves. *Inflorescences* to 10 cm, pale gray-green to pale creamy brownish green; flowers fragrant. *Staminate flowers* 1.1–1.5 mm diam., (dirty) creamy white; bracts triangular, ca. 2.2 × 1.5–2.2 mm, margin entire, with a round, shiny extrafloral nectary at base, bracteoles not seen; pedicels 0.3–0.7 mm; calyx 1.3–2 mm high, with 3 or 4 lobes, latter 0.4–0.8 × 0.8–1 mm; stamens 5 to 7, androphore 0.7–1.5 mm, filaments 0.4–1 mm, sulcate, anthers ca. 0.3 × 0.6–0.7 mm, thecae divergent, yellow; pistillode 0.8–1 mm, 1- or 2-lobed. *Pistillate flowers* 3.6–3.7 mm diam., greenish cream; bracts triangular, 2–3.3 × 0.6–2 mm, margin entire, basally with 1 or 2 glands; bracteoles smaller, 1.2–1.3 × 0.3–1 mm; pedicels 0.8–1 mm, lengthening in fruit to 5 mm; calyx basally united, to 3.2 mm high (enlarging in fruit to ca. 18 mm), lobes 6, triangular, 2.3–2.8 × 1–1.5 mm (enlarging in fruit to ca. 8 × 8 mm), extrafloral nectaries absent; ovary 3-locular, ca. 1.5 × 1 mm, style 0.8–1.6 mm, stigma 4–5.5 mm, pale (greenish) yellow to pale purplish white, the apex split into 2 major branches, each with 3 lobes, stigmas individually visible. *Fruits* lobed regmata, only young one seen, ca. 10 × 6 mm, dull brownish green or yellowish green; wall ca. 0.8 mm thick; columella ca. 6 × 4–4.5 mm. *Seeds* ca. 6 × 6 × 5.3 mm.

Distribution, habitat, and phenology. *Koilodepas cordisepalum* is endemic in Sumatra (Province Aceh, Gunung Leuser Nature Reserve), where it is found in (logged) primary hill forest and riverine forest, on sandstone, alluvial, or yellow-red loamy (rich in lime) soil between 40 and 400 m; the species flowers in July and August and fruits in May and July.

IUCN Red List category. *Koilodepas cordisepalum* is considered Vulnerable (VU B1a) according to IUCN Red List criteria (IUCN, 2001). The species is deemed vulnerable because it is only present in a few locations in the Gunung Leuser National Park in northern Sumatra. The park is under threat due to clearance for road-building and oil palm plantations, with the forested area diminishing in size and quality each year (De Wilde, pers. comm.).

Discussion. Airy Shaw (1981: 311) previously indicated that material from Sumatra (*de Wilde & de Wilde-Duyfjes 12463*) might be a new species, but due to lack of sufficient material, he referred the specimen to *Koilodepas* cf. *hainanense* on the basis of the enlarging pistillate sepals and green color of the dry leaves. However, the type of *K. hainanense* (*W. Y. Chun 1092*, A!) has leaves that dry brown and pistillate flowers with much shorter stigmas (to 3.2 mm long). Thus, the specimens from Sumatra are indeed an identifiable new species. Other typical characters for this new species are the coarsely serrulate leaf margin and slightly bullate venation; the five to seven stamens that are connate at base; the pistillate calyx that is 3.2 mm high and enlarges up to 18 mm in fruit, and of which the six lobes are 2.3–2.8 × 1–1.5 mm and enlarge to a length of ca. 8 mm; and the long style (0.8–1.6 mm) and stigmas (4–5.5 mm). In morphology, the species closely resembles *K. calycinum* from India and *K. hainanense* from Thailand to southwest China.

Paratypes. INDONESIA. **Sumatra.** Aceh: Gunung Leuser Nature Reserve, Ketambe, valley of Lau Alas, near tributary of Lau Ketambe, ca. 35 km NW of Kutatjane, *W. J. J. O. de Wilde & B. E. E. de Wilde-Duyfjes 12463* (L); Kloët Nature Reserve, Sungai Kloët, along Krung Lembang, ca. 20 km upstream, E of Kandang, 3°05′N, 97°25′E, *W. J. J. O. de Wilde & B. E. E. de Wilde-Duyfjes 19626* (L); vic. Pucuk Lembang, 3°05′N, 97°25′E, *W. J. J. O. de Wilde & B. E. E. de Wilde-Duyfjes 19780* (L); along Krung Lembang, vic. Pucuk Lembang, 3°05′N, 97°25′E, *W. J. J. O. de Wilde & B. E. E. de Wilde-Duyfjes 19914* (L); Middle Alas River (Lae Sauraya), ca. 15 km N of Gelombang, S of Bengkong River, near the simpang with Lae Sebelin, 2°55′N, 97°57′E, *W. J. J. O. de Wilde & B. E. E. de Wilde-Duyfjes 20207* (L); P.T. Hargas logging concession, S of rd. Sibulussalam–Gelombang, just N of crossing of approach rd. with Lae Batu Batu, near abandoned village of Belingtang, 2°43′N, 97°54′E, *W. J. J. O. de Wilde & B. E. E. de Wilde-Duyfjes 20623* (L).

5. **Koilodepas hainanense** (Merr.) Croizat, J. Arnold Arbor. 23: 51. 1942, as *"Coelodepas."* Basionym: *Calpigyne hainanensis* Merr., J. Arnold Arbor. 6: 135. [30 July] 1925. TYPE: China. Hainan: Nam Fung [Nam Fong/Namfeng], 21 Mar. 1920, *W. Y. Chun 1092* (holotype, A!; isotype, A!). Figures 2D, 3G–I.

Nephrostylus poilanei Gagnep., Bull. Soc. Bot. France 72: 467. [Aug.] 1925, syn. nov. TYPE: Vietnam. Annam Prov., Phanrang, Ca-na, 8 Mar. 1923, *E. Poilane 5694* (holotype, P!; isotype, P!).

Tree(let)s, to 15 m high, to 4 cm DBH; flowering branches 1.5–2.3 mm thick. *Bark* smooth, gray-brown. *Stipules* triangular, 3.5–8 × 1–1.5 mm, margin slightly erose, with some up to 1-mm-long teeth, glands absent. *Leaves* with the petiole 0.5–1.2 mm, somewhat flattened above; blade elliptic-oblong (to ovate to obovate), 6.5–22.5 × 2.1–7.5 cm, length: width ratio 3–3.5:1, drying brownish green to sometimes green, base obtuse to rounded, flat, margin flat, finely serrulate with glandular teeth to (secondarily) almost entire, apex acuminate, adaxial surface dark green, abaxial surface slightly pubescent on major venation, slightly paler than adaxially, nerves 10 to 18 per side. *Inflorescences* up to more than 10 cm; flowers lemon-yellow, scent strong, unpleasant. *Staminate flowers* 1–1.5 mm in diam.; bracts ovate to triangular, ca. 1.7 × 2.2 mm, margin entire, glands absent; pedicels 0.1–0.4 mm; calyx 1–1.2 mm high, with 3 or 4 lobes, latter 0.7–1 × ca. 0.7 mm; stamens 4 or 6, androphore ca. 0.3 mm, filaments ca. 0.6 mm, sulcate, anthers ca. 0.3 × 0.6 mm, thecae divergent, yellow; pistillode ca. 0.3 mm, broad. *Pistillate flowers* 2.5–4.8 mm diam.; bracts long-triangular, 5–5.3 × ca. 1 mm, margin entire to glandular-toothed; bracteoles like bracts, broad-triangular, 2–3.5 × 1.2–1.8 mm; pedicels short to up to 18 mm in fruit; calyx basally united, up to 3.5 mm high (enlarging in fruit to ca. 19 mm), lobes 8 to 10 (enlarging in fruit to 18 × 6 mm), folded around ovary, with extrafloral nectaries in mainly the united part; ovary 3-locular, ca. 2 × 1.5–2 mm, style absent, stigmas 2–3.2 mm, flat and spreading, top broad and hardly split to split into 2 major branches and each branch split several times less deep, fanlike, individual stigmas not visible. *Fruits* lobed regmata, 12–15 × 10–11 mm, green with orange tinge to brown-green; wall ca. 0.8 mm thick; columella 6–8 × 5–7 mm. *Seeds* ca. 6 × 6 × 5 mm.

Distribution, habitat, and phenology. *Koilodepas hainanense* is found in China (Hainan), northern Vietnam, and southeastern and southwestern Thailand, and is locally fairly common in (disturbed) primary evergreen forest, often along rocky shores of streams on sandy soil above a granite bedrock at altitudes to 320 m; the species flowers in March and June and fruits in March, April, May, and August.

Vernacular name. China: pak tsa shu.

Discussion. Airy Shaw synonymized *Nephrostylus poilanei* with *Koilodepas longifolium* (1960), but later changed his mind (1963) and placed both *Calpigyne hainanensis* and *N. poilanei* within the synonymy of *K. wallichianum* [= *K. longifolium* herein]. Herein, *K. hainanense* is considered a distinct species and includes the synonym *N. poilanei*. The two epithets were published in the same year, but Merrill's name (*C. hainanensis*) was published a few months before Gagnepain's name (*N. poilanei*; see above). Therefore, Croizat's new combination of Merrill's name is the correct name. *Koilodepas hainanense* differs from *K. bantamense* and *K. longifolium* in that the pistillate calyx enlarges with fruit maturity. See the discussion under *K. bantamense* for further differences among these species.

Additional specimens examined. CHINA. **Hainan:** Ching Mai Distr., Tai Wong Ling, Tung Pin Tin village, *C. I. Lei 536* (L). THAILAND. **South-eastern:** Trat Prov., Koh Chang Island, Tham Mayom Waterfall, 12°00′N, 102°40′E, *C. F. van Beusekom & T. Santisuk 3188* (L); Trat Prov., Koh Kut Island, hills around Ao Yai Bay, 12°00′N, 102°40′E, *C. F. van Beusekom & T. Santisuk 3207* (L); Trat Prov., Koh Chang Island, near Had Sai Daeng, 12°00′N, 102°40′E, *R. Geesink, T. Hattink & C. Phengklai 6645* (L). **South-western:** Phetchaburi Prov., Kaeng Krachan, Kaeng Krachan Natl.

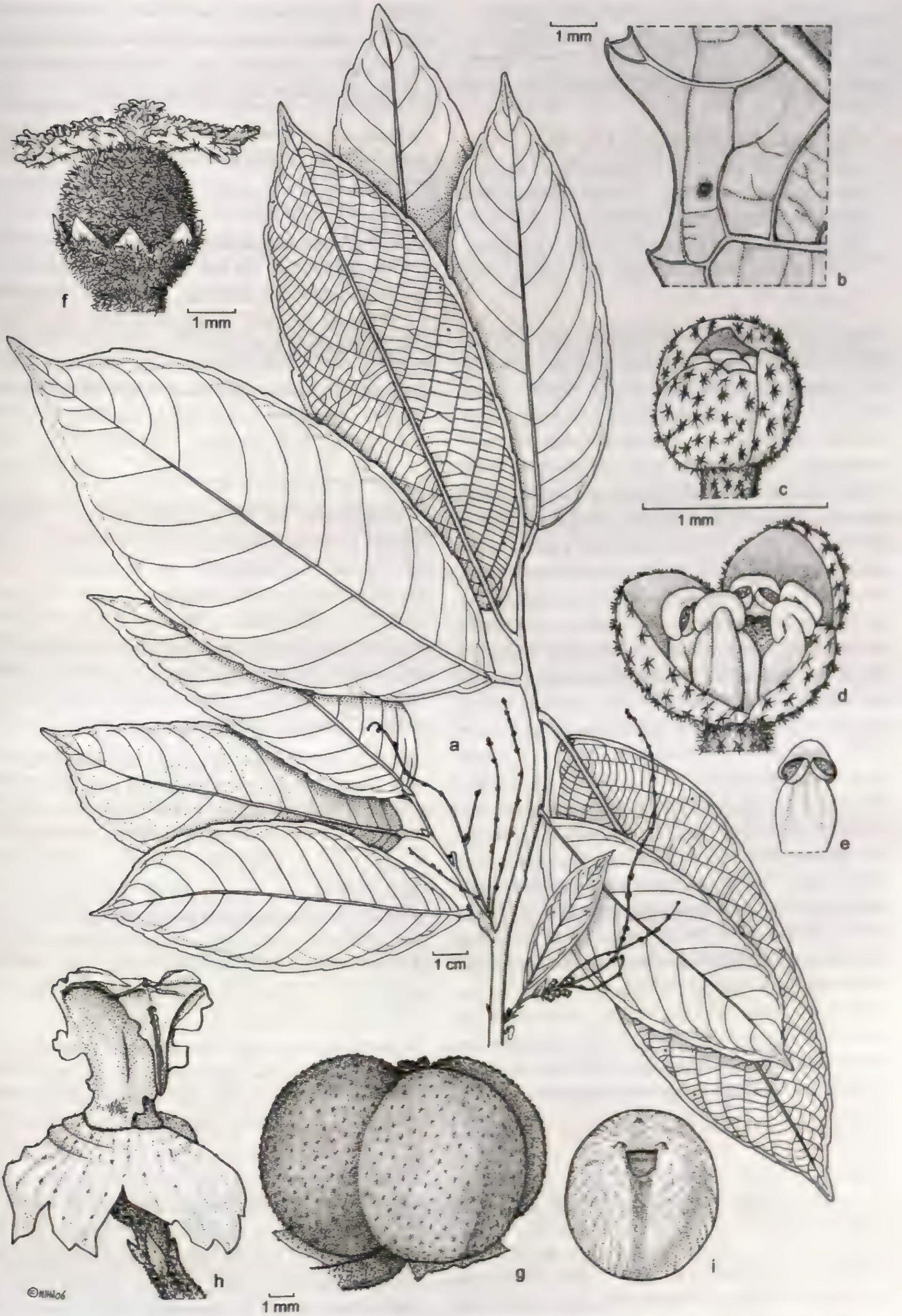

Figure 3. A–F. *Koilodepas longifolium* Hook. f. —A. Habit. —B. Leaf blade margin with abaxial extrafloral nectary visible. —C. Staminate bud. —D. Staminate bud, with one sepal removed to show stamens and pistillode. —E. Stamen. —F. Pistillate flower. G–I. *Koilodepas hainanense* (Merr.) Croizat. —G. Fruit. —H. Columella after dehiscence. —I. Seed. A drawn from *Kostermans & Anta 717* (L); B–F drawn from *Rahim A 409* (L); G–I drawn from *van Beusekom & Santisuk 3188* (L).

Park, trail to Pongmu, 12°50′24″N, 99°18′E, *D. J. Middleton et al. 3342* (L). VIETNAM. Phong Nha, Km 19 HCM Hwy., western, *Nguyen Nghia Thin 010812.17* (L). **Ninh Thuan:** Phan-rang, 11/14 June 1909, *C. d'Alleizette s.n.* (L).

6. Koilodepas homaliifolium Airy Shaw, Kew Bull. 36: 609. 1981. TYPE: [Papua New Guinea.] Terr. of New Guinea, Central Distr., Port Moresby sub-distr., Kuriva Forestry Area, near Veimauri River, 6 May 1971, *H. Streimann & A. Kairo LAE 51550* (holotype, K!; isotype, L!). Figure 1C, I.

Trees, to 24 m high, bole to 18 m, straight, to 38 cm DBH; crown spreading; flowering twigs ca. 3 mm in diam. *Outer bark* brown to dark gray, papery, flaky; middle and inner bark red, layered; wood very hard and heavy, sapwood straw-colored, heartwood yellowish straw colored. *Stipules* oblong-ovate, 4.3–9 × 1–1.5 mm, margin entire but apically sometimes erose, glands not observed. *Leaves* with young flush drying reddish; petioles 3–8 mm, channeled above; blade elliptic-oblong, 10.5–23 × 4.1–8.3 cm, length:width ratio 2.6–3.3:1, drying brown, base emarginate to broadly cuneate, margin laxly serrulate, teeth rounded, glandular, apex acute to acuminate, adaxial surface dark green, abaxial surface somewhat pubescent when young, especially on venation, green, nerves 11 to 15 per side. *Inflorescences* to 16 cm; flowers gray to yellow. *Staminate flowers* ca. 1 mm diam.; bracts triangular, ca. 1.8 × 1.8 mm, margin probably entire (not well visible in scarce material), extrafloral nectaries not seen; pedicel at most ca. 0.3 mm; calyx 3-lobed, lobes almost completely free, elliptic, ca. 1 × 0.7 mm, apex rounded; stamens 4, androphore ca. 0.3 mm, filaments 0.5–0.7 mm, sulcate, anthers ca. 0.3 × 0.5 mm, thecae divergent; pistillode present. *Pistillate flowers* ca. 4.2 mm diam., sessile; bracts triangular, ca. 2.5 × 0.8 mm; bracteoles minute; calyx 6-lobed, ca. 2.1 mm high, lobes acute; ovary 3-locular, ca. 2 × 1.5 mm; style ca. 0.5 mm, stigmas ca. 2.5 mm, apex multifid, individual stigmas visible. *Fruits* and *seeds* unknown.

Distribution, habitat, and phenology. Koilodepas homaliifolium is endemic in Papua New Guinea (Central Province) in the understory of lowland rainforest at ca. 70 m; the species flowers in February and May.

Discussion. Airy Shaw (1980: 122) already noticed that the single specimen then known from New Guinea constituted a new species. More material confirmed his view. Typical for the species are the long, narrow, mainly entire stipules, the leaves drying brown, the almost free pistillate calyx lobes, and the stigmas that can be individually seen. It is the only species of *Koilodepas* from New Guinea and is probably related to the west Malesian species with a non-enlarging pistillate calyx with almost free lobes (e.g., *K. laevigatum* and *K. longifolium*).

Additional specimens examined. PAPUA NEW GUINEA. **Central:** Mt. Lawes, 200 ft., 9°30′S, 147°10′E, *K. J. White NGF 10732* (L).

7. Koilodepas laevigatum Airy Shaw, Kew Bull. 23: 83. 1969. TYPE: Malaysia. Sarawak: 4th Division, Bukit Mersing, Anap, 24 Aug. 1964, *Sibat ak Luang S 21928* (holotype, K!; isotype, L!). Figure 2B, C, H.

Koilodepas longifolium Hook. f. var. *integrifolium* Airy Shaw, Kew Bull. 14: 388. 1960. TYPE: [Malaysia. Sabah:] British North Borneo, Bongkoka Kadas, 135 ft., 27 Apr. 1932, *P. Orolfo 1821* (holotype, K!; isotype, L! [incorrectly as *P. Keeper 1821*]).

(Small) trees, to 15 m high, bole to 5 m high, straight, to 28 cm DBH; flowering branches 2–3 mm thick. *Outer bark* smooth to much grooved to flaky, gray or grayish white to white-brown, thin or papery; inner bark pale green to orange-yellow to reddish yellow to ochre, hard; sapwood pale white to yellowish orange. *Stipules* triangular, 2–4 × 1–1.7 mm, margin erose, late caducous, glands absent. *Leaves* with the petiole 6–11 mm, channeled above; blade elliptic to oblong (to ovate), 13.5–34 × 3–13 cm, length:width ratio 3.3–4.5:1, drying green, base broadly cuneate, margin irregularly entire, seldom with one or a few teeth near the apex, flat, apex acuminate to cuspidate, abaxial surface glabrous, nerves ca. 12 per side. *Inflorescences* to 7 cm. *Staminate flowers* 1–1.3 mm diam. (excluding stamens), pale greenish to whitish to pale yellow; bracts ovate, ca. 2 × 1.6 mm, margin slightly erose, basal marginal gland on one side; pedicels ca. 0.3 mm; calyx 1.2–1.4 mm high, glabrous, with 2 or 4 lobes, lobes triangular, ca. 0.6 × 0.6–1.2 mm; stamens 4 or 5, androphore ca. 0.9 mm, filaments threadlike, 1.3–2.4 mm, white, anthers ovate, ca. 0.4 × 0.2–0.3 mm, thecae parallel, green; pistillode ca. 0.3 mm. *Pistillate flowers* ca. 2 mm diam. (excluding stigma), green to yellowish white to white; bracts ovate, 2.3–2.5 × 2–2.3 mm, margin erose; bracteoles like bracts, triangular, 1.7–1.8 × 0.7–0.8 mm; pedicel ca. 2 mm, extending to 12 mm in fruit; calyx with 8 to 12 lobes, basally connate, lobes triangular, 0.7–2 × 0.5–1.7 mm, usually glands on united part and on lobe apices; ovary ca. 2.3 × 3 mm, 3-locular, light green with ochreous brown hairs to pink, style 0.5–1 mm, stigmas 3.3–6 mm, lower half folded, upper half deeply bilobed, stigmas individually visible. *Fruits* lobed regmata, 15–18 × 10–11 mm, pale gray and white (immature) to pale yellowish; calyx ± recurved; wall ca. 1.5 mm thick; columella 9–10 × 8–9 mm. *Seeds* 8–10 × 8–10 × 6.5–8.7 mm.

Distribution, habitat, and phenology. *Koilodepas laevigatum* is endemic to Borneo (Sabah, Sarawak, Kalimantan Timur), where it is found in primary dipterocarp forest and secondary forest, generally on hills on sandy soil, sandstone with shale, basalt, and conglomerated clay-stone and sandstone at altitudes up to 750 m; the species flowers in February to May and August to October, and fruits in May and August.

Vernacular names. Malaysia, Sabah: akar, kilas (Malay); pilas (kayu) (Kedayan) (Keith, 1938, 1952, as "*Aporosa brevipetiolata*"); puti [?pati] (Dusun Rongos); kilas (Bajau Lobok); rongrongkoi (Malay); kelis-kelis (Dusun Kinabatangan). Sarawak: puti (Iban) (Airy Shaw, 1960).

Discussion. *Koilodepas laevigatum* is one of the species of *Koilodepas* found on Borneo, which is a hot spot for this genus. When flowering, *K. laevigatum* can be distinguished from other species of *Koilodepas* by the different type of stamen (threadlike filaments, parallel thecae) and the pistillate calyx that does not enlarge in fruit. Vegetatively, the leaf blades are generally larger than those of the other Bornean species, and they dry green instead of generally brown.

Additional specimens examined. INDONESIA. **Kalimantan Tengah:** Plot 3, Sangai, Sungai Mentaya, Kab. Kotawaringin Timur, 1°29′S, 112°31′E, *E. R. Latupeirrissa 94388* (L). **Kalimantan Timur:** Berau Inhutani area, Km 37, near transect I, plot 4, *Ambriansyah et al. Berau 837* (L); Gunung Buntung, 1°50′N, 117°15′E, *R. Geesink 9344* (L); Gunung Buntung, ca. 70 km S of Tanjung Redeb, Berau, 1°30′N, 117°20′E, *M. Kato, M. Okamoto & K. Ueda B-11899* (L). MALAYSIA. **Sabah:** Kinabatangan, H.S. Bod Tai, Sukau, *Amin et al. SAN 69993* (L); Labuan Forest Reserve, *Apostol 6282* (L); Kalabakan, Gunung Rara Forest Reserve, about 30 mi. NW of Luasong Camp, *J. Chow SAN 75343* (L); E of Sungai Menanggul, Bukit Garam, *George et al. SAN 117587* (L); Kota Marudu, Kampung Palu Sumbu, *A. Gibot SAN 100030* (L); Pandewan, Sungai Pamentarian, *F. Krispinus SAN 120047* (L); Sandakan, Sepilok Forest Reserve, Jalan Hujong Tanjong, *W. Meijer SAN 141519* (L); Brantian, Kalabakan, *K. Muroh SAN 75304* (L); Sandakan, Sepilok Forest Reserve, Compart. 13, *D. I. Nicholson SAN 21776* (L); Danum Valley, *C. E. Ridsdale 1965* (L); Kudat, Loro Forest Reserve, *H. T. Sinanggol SAN 51113* (L); Beaufort Distr., Beaufort Hill, 1 mi. NE of Beaufort Township, *G. H. S. Wood & Kapis bin Sisiron SAN 16834* (L). **Sarawak:** 4th Division, Sungai Jelalong, Dataran Tinggi Merurong, Sungai Ebau, *Othman, Yii et al. S 48861* (L); 3rd Division, Kapit, path to Bukit Mabong, Ulu Selada, Melinau, *I. Paie S 24270* (L); Tau Range, Bukit Mersing, *J. W. Purseglove P.5195* (L).

8. **Koilodepas longifolium** Hook. f., Fl. Brit. India 5: 420. 1887. TYPE: Malaysia. Perak, Larut, Aug. 1884, *King's collector 6502* (holotype, K!). Figures 1D, H, 2A, 3A–F.

Koilodepas glanduligerum Pax & K. Hoffm. in Engl., Pflanzenr. IV, 147. vii: 270, fig. 42d. 1914, as "*Coelodepas*." TYPE: Singapore. Garden Jungle, 1894, *H. N. Ridley 6481* (lectotype, designated here, K!; duplicate, L!).

Koilodepas subcordatum Gage, Rec. Bot. Surv. India 9: 239. 1922, as "*Coelodepas subcordatus*." TYPE: Malaysia. Malay Peninsula, Penang, Bukit Penara, Oct. 1887, *C. Curtis 1271* (lectotype, designated by Airy Shaw, 1960: 387, K!).

Small trees, to 12 m high, to 18 cm DBH; flowering branches 1.5–2.3 mm thick. *Outer bark* white to light brown, smooth, slightly papery; inner bark pink, thin; wood yellow. *Stipules* triangular, 3.7–8 × 1–1.2 mm, late caducous, margin with several upright teeth (to entire or somewhat erose), basal glands absent. *Leaves* with petiole 3–20 mm, round; blade elliptic to elliptic-oblong, 8.5–27 × 2.7–8.2 cm, length:width ratio 3.1–3.2:1, drying brown, base rounded to cuneate, margin coarsely serrulate (to entire), flat to slightly recurved, teeth ending in a small and narrow gland, apex acuminate to cuspidate, sometimes mucronulate, adaxial surface medium to very dark green, shiny, abaxial surface glabrous to pubescent along midrib and basal nerves (Borneo), paler green, nerves 9 to 15 per side, sometimes somewhat bullate between nerves. *Inflorescences* to 12 cm, dark yellow, sometimes with witch brooms, dark brown pubescent, branching, with flowers consisting of calyx cups, each containing a short spike of bracts. *Flowers* pale green with a silvery tinge to cream to yellow. *Staminate flowers* 0.8–1.3 mm diam.; bracts broadly ovate, 0.7–1.8 × 1–2 mm, sometimes split or margin erose, the basal part of the margin sometimes with round extrafloral nectaries; pedicels 0.2–0.8 mm; calyx with 3 or 4 lobes, lobes entire or bilobed, sometimes split and seemingly 3 or 4 free sepals, 0.9–1.2 mm high, teeth triangular, 0.5–0.6 × 0.4–0.8 mm, all acute; stamens 4 or 5(or 6), androphore 0.2–0.4 mm high, filaments 0.5–0.6 mm, sulcate, anthers ca. 0.3 × 0.4 mm, thecae divergent; pistillode absent to 0.4 mm. *Pistillate flowers* 1.7–3 mm diam.; bracts triangular 2.5–4.7 × 0.7–1 mm, sometimes glandular, margin often erose; bracteoles similar to bracts, 1.2–2.5 × 0.4–0.9 mm; pedicel 0.8–2.3(–11 in fruit) mm; calyx only enveloping lower half of ovary, 0.6–1 mm high, slightly enlarging in fruit to 2 mm high, 6- to 12-lobed, lobes triangular, 0.6–1 × 0.4–0.8 mm, usually with extrafloral nectaries on outside of tube; ovary (2)3-locular, 1.7–2 × 1.8–2 mm, style 0–0.8 mm, stigmas 1.5–2.1 mm, deeply bilobed apically for 1–2.2 mm, each lobe split somewhat, stigmas individually visible. *Fruits* lobed regmata, 12–14 × 8.5–

10 mm, dark yellow to brown; wall 0.8–1 mm thick; columella broadly obtriangular, 6–6.5 × 4–6 mm, with a few caducous stellate hairs basally. *Seeds* 6.5–7 × 7–7.5 × 5.2–6 mm.

Distribution, habitat, and phenology. *Koilodepas longifolium* is present in southern Thailand (Yala), the Malay Peninsula (including Singapore), Sumatra (Riau Province, Bangka Island), and Borneo (Sabah, Brunei, Sarawak), where it can be found in primary mixed lowland dipterocarp forest and kerangas forest on sandstone, diorite scree, granitic sand, sandy clay, or clay loam at altitudes between 6 and 330 m; it flowers in January to October and December and fruits in January, June, July, and September. Small black ants create "earth" nests among the fruits.

Vernacular names. Peninsular Malaysia: semantum. Borneo, Sabah: kilas (Brunei Benuni); Sarawak: bantas (Iban).

Discussion. *Koilodepas longifolium* is characterized by the narrow glands at the end of the teeth of the leaf margin, the short pistillate calyx (only enveloping the lower half of the ovary) with non-enlarging lobes, and the stipules with teeth that point upward. The species concept within the *K. bantamense–K. hainanense–K. longifolium* complex (see discussion under *K. bantamense*) appeared to be difficult and many identifications were incorrect. A similar problem occurred with the syntypes used to describe *K. glanduligerum* and *K. subcordatum*; they too were mixed collections, which necessitated the selection of lectotypes. *Koilodepas subcordatum* was lectotypified by Airy Shaw (1960: 387), but *K. glanduligerum* still requires lectotypification. Of the three specimens cited by Pax and Hoffmann (1914: 270), one specimen (*H. N. Ridley s.n.*, Malay Peninsula, Bukit Timah) could not be located and the other (*H. N. Ridley 4226*, K) appears to represent *K. bantamense*. The remaining specimen, *H. N. Ridley 6481* (K), is therefore designated as lectotype here.

Additional specimens examined. BRUNEI. **Belait:** Labi, Sungai Rampayoh, 4°22′N, 114°28′E, *M. J. E. Coode et al. 7825* (L); Andalau Forest Reserve, Compart. 6, *G. H. S. Wood, B. E. Smythies & P. S. Ashton SAN 17558* (L). INDONESIA. **Sumatra.** Riau: Tandjong Pinang, *Teijsmann s.n.* (L [barcodes L 0034877, L 0034878]). Sumatera Selatan: Bangka, Gunung Mangkol, *A. J. G. H. Kostermans & Anta 717* (L). MALAYSIA. **Johor:** Kluang Forest Reserve, *P. F. Cockburn FRI 7537* (L); Gunung Panti Forest Reserve, Compart. 64 East, *P. F. Cockburn FRI 7722* (L); Panti Forest Reserve, *K. M. Kochummen FRI 29047* (L). **Pahang:** Ulu Dong Forest Reserve, *L. E. Teo & G. Pachiappan KL 2659* (L). **Perak:** Dindings, South Pangkor Forest Reserve, *H. M. Burkill & M. Shah HMB 179* (L); Dindings, South Pangkor Forest Reserve, *H. M. Burkill & M. Shah HMB 184* (L). **Pulau Pinang:** Pangkore, *C. Curtis 1374* (K, paratype of *K. subcordatum*). **Sabah:** Kalatuan, *A. Rahim A 409* (L). **Sarawak:** Gunung Santubong, *P. S. Ashton S 21494* (L); 4th Division, Miri Distr., Niah River, Ulu Sungai Sekaloh, *E. Wright S 29117* (L); Baram, Marudi Forest Reserve, *A. Yacup S 8292* (L). SINGAPORE. Nee Soon, *Hardial 352* (L); Upper MacRitchie Reservoir area, *J. F. Maxwell 81-113* (L); Yeo Chu Kang Rd., 15 Apr. 1901 & 9 Oct. 1901, *H. N. Ridley s.n.* (K); Botanic Gardens' Jungle, Jan. 1915, *H. N. Ridley s.n.* (K); Botanic Gardens' Jungle, *J. Sinclair SF 40668* (L). THAILAND. **Peninsular:** Pattani, Yala, *N. Put 3696* (L).

9. **Koilodepas pectinatum** Airy Shaw, Kew Bull. 23: 82. 1969. TYPE: Malaysia. Sabah: Lahad Datu, Block 62, Silabukan Forest Reserve, Kennedy Bay, 15 Oct. 1963, *H. T. Sinanggul SAN 39941* (holotype, K!; isotype, L!). Figures 1E, 2F.

(Shrubs to) small trees, to 17 m high, bole to 11 cm high, to 8 cm DBH, girth 45 cm; flowering branches 2–3.5 mm thick. *Outer bark* smooth, whitish to gray to black, papery; inner bark pale yellow to yellowish red to red to brown; sapwood white to yellow to orange-yellow, medium-hard. *Stipules* oblong-ovate, 10–13 × 1.5–3 mm (excluding teeth), pectinate with up to 6-mm-long teeth, teeth perpendicular to main part, with secondary perpendicular teeth. *Leaves* with petiole 3–15 mm, round to reniform near blade; blade oblong, 7–28 × 2.4–10.7 cm, length:width ratio 2.6–3.8:1, drying brown, base rounded, margin serrulate with glandular teeth, apex acuminate to caudate, abaxial surface subglabrous to rather pubescent, most often on venation, nerves 10 to 14 per side, often bullate between nerves. *Inflorescences* to 12.5 cm, hairy, pale green. *Flowers* white to yellowish green to reddish to brownish green. *Staminate flowers* ca. 1 mm diam.; bracts ovate to triangular, 1.7–2 × 1.5–1.8 mm, at base sometimes with small bracteoles or extrafloral nectaries, margin with raised glands; pedicel ca. 0.3–0.8 mm; calyx 3-lobed, lobes easily detaching, ca. 1 mm high; stamens 4, androphore 0.2–0.4 mm high, filaments ca. 0.7 mm, sulcate, anthers ca. 0.3 × 0.5 mm, thecae divergent; pistillode absent. *Pistillate flowers* with bracts ovate to triangular, ca. 5 × 2.5 mm, margin with raised glands; bracteoles similar to bracts, ca. 3 × 2 mm; sepals (6 to)10, free, ovate, 3–3.3 × 1.2–1.3 mm, enlarged in fruit up to ca. 3 × 1.5 cm, purple, margin with raised glands; ovary 3-locular, style 1–3 mm, stigmas 2.7–3 mm, deeply bifid, apices multifid, yellow, fanlike, individual stigmas not visible. *Fruits* regmata, 1.3–2 × 1.1–1.3 cm, greenish to brownish; columella ca. 9 mm. *Seeds* obovoid, 8–10 × 8–9 × 7–7.5 mm.

Distribution, habitat, and phenology. *Koilodepas pectinatum* is seemingly rare in the Malay Peninsula (one specimen: *Stone & Sidek 12616*) and mainly endemic in Borneo (Sabah, northeast Kalimantan), where it is present in primary lowland dipterocarp forest, secondary forest, logged-over forest, open areas along logging roads, and along rivers at altitudes between 50 and 850 m; occasionally it is found on limestone. The species flowers in March, April, June through October, and December and fruits in February, March, and July through December.

Discussion. Of the species in the genus *Koilodepas*, *K. pectinatum* is the easiest to recognize because of the pectinate stipules. Other species have stipules with teeth, but these teeth point upward; in *K. pectinatum* the teeth are patent, perpendicular to the main axis of the stipule, and often possess smaller, also patent teeth.

Additional specimens examined. INDONESIA. **Kalimantan Tengah:** Upper Katingan River, ca. 50–100 km WNW of Tumbang Samba, ca. 1°15′S, 112°40′E, *J. P. Mogea 4314* (L). **Kalimantan Timur:** Sepaku, P.T. ITCI, plot 71-1, 1°S, 117°E, *Ambriansyah & Z. Arifin AA32* (L); P.T. ITCI area, permanent growth and yield plot no. 72-2, *K. Sidiyasa 657* (L); Gunung Buntung, 1°50′N, 117°15′E, *R. Geesink 9333* (L). MALAYSIA. **Kelantan:** Gua Musang, *B. C. Stone & M. Sidek 12616* (L). **Sabah:** Tongod, Ulu Sungai Pinangah, Pinangah Forest Reserve, *Amin et al. SAN 107125* (L); Kalabakan, Gunong Rara Forest Reserve, Coupe 1972, *J. Chow SAN 75669* (L); Nabawan, Shang Lian unlogged area, *F. Krispinus SAN 109947* (L); Kalabakan, Hiap logged area, Gunung Tembuku, *F. Krispinus & Sumbing SAN 91753* (L); Kalabakan, Hiap logged area, Gunung Tembuku, *F. Krispinus & Sumbing SAN 91770* (L); Lahad Datu, Danum Valley, Coupe 1991, *J. Kulip, L. Madani & Donggop SAN 133305* (L); Lamag, Rail mi. 10.5 Tenegang Besar, Timber Camp, Kinabatangan, *P. Lassan SAN 63541* (L); Lahad Datu, H.S. Sungai Segama, *L. Madani & Ismail SAN 108689* (L); Sandakan, H.S. Sungai Sapi, *Mansus et al. SAN 116822* (L); Beluran, Sungai Melinau, *A. Rahim et al. SAN 99807* (L); Sandakan, Ullu Sungai Pinangah, *Sigin et al. SAN 100273* (L); Sandakan, Ulu Sungai Pinangah, *Sigin et al. SAN 107195* (L); Tongod, Bukit Mengalas-Kalas, Keramuak, *D. Sundaling SAN 93556* (L); Tongod, Kinabatangan, Sungai Enodol, *D. Sundaling SAN 99463* (L); Lahad Datu, Yayasan Sabah area, Malua Forest Reserve, *D. Sundaling SAN 129651* (L); Tongod, Kampung Ulu Menanam, *D. Sundaling & P. Lasan SAN 89277* (L); Tongod, Pinangah Forest Reserve, *D. Sundaling & Mansus SAN 67476* (L); Tongod, Bukit Tinker, Karamuok, *D. Sundaling et al. SAN 97296* (L).

EXCLUDED SPECIES

Koilodepas hosei Merr., Philipp. J. Sci. 11: 66. 1916, as "*Coelodepas*." TYPE: [Malaysia. Borneo:] Sarawak, Baram Distr., Entoyut River, 13 Nov. 1894, *C. Hose 465* (holotype, K not seen; isotype, L!). [= *Claoxylon hosei* (Merr.) Airy Shaw].

Airy Shaw (1960: 391) already noted that the type specimen of *Coelodepas hosei* is a pistillate specimen of the genus *Claoxylon* A. Juss. Vegetatively, the two genera can easily be separated. The dried leaves of *Koilodepas* are smooth, while those of *Claoxylon* generally feel rough. The roughness is caused by styloid crystals that protrude through the epidermis once the leaves are dried (Kabouw et al., 2008). These crystals are absent in *Koilodepas*.

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